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AUTHOR Fidler, James R.; And Others
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ABSTRACT

This experiment was designed to better understand the effects of individual differences, intent to learn, and stimulus familiarity on frequency judgment accuracy. Half of the participants in the study heard popular songs, and the other half listened to unfamiliar songs. Participants were subdivided into three more groups, introducing the "intent to learn variable". They were (1) aware of an upcoming frequency test, (2) aware of an upcoming memory test, or (3) given a distractor task of completing a math test. A series of taped 10-second song excerpts, separated by 5-second silent intervals, were played to participants. Sixteen songs were repeated at varying frequencies throughout the tape. Participants were asked to judge how many times they had heard each song. Analyses of variance were performed on mean frequency of each group. Persons judging unfamiliar music tended to inflate their frequency estimates compared to persons judging familar music. Frequency judgment ability seemed to be impaired for persons in the distractor condition. High music-knowledge persons exhibited superior frequency judgment accuracy. (LMO)

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MEMORY FOR FREQUENCY OF HEARING POPULAR MUSIC

JAMES R. FIDLER AND EUGENE B. ZECHMEISTER

Loyola University of Chicago

JOHN J. SHAUGHNESSY

Hope College

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Memory for Frequency of Hearing Popular Music

The research I will be describing today deals with people's abilities to remember the number of times they have experienced an event. Hasher and Zacks (1979) argue that this ability is automatic. As such, frequency encoding should take place without an individual being aware of its operation, and with little effort. In addition, frequency encoding, if entirely automatic, should be unaffected by prior instructional set (Flexser & Bower, 1975) which manipulates the intentionality of frequency encoding; that is, there should be no difference in frequency estimation ability under intentional and incidental learning instructions. In fact, Hasher and Zacks (1984) recently stated that no study which they have reviewed "has ever found that instructions influenced performance on a test for memory for frequency of occurrence" (p.1374). However, Greene (1984) and Fisk and Schneider (1984) interpret results from their recent studies to suggest that intent to learn the stimulus material does indeed affect frequency judgment ability.

Hasher and Zacks (1984) have also stated that "Individual characteristics that are usually important for cognitive performance are irrelevant to the storage of information about the occurrences of events" (p.1376). However, we recently found evidence suggesting that individual differences and stimulus familiarity indeed affect accuracy of frequency estimation. In a study previously reported, we found positive correlations between people's knowledge of rock music, and the accuracy of their

frequency judgments for the number of times they heard song excerpts of rock music, as well as a familiarity effect for absolute judgments of frequency. These results, to us, did not seem compatible with a strong theory of automatic encoding. To better understand the effects of individual differences, intent to learn, and stimulus familiarity on frequency judgment accuracy, we undertook the experiment to be reported today.

If you will look at Table 1, ignoring the numbers within the boxes for a moment, you will see that our experiment had six groups. The effect of familiarity was assessed by having half of the groups estimate the frequency of popular, often heard songs, and requiring the other half of the groups to estimate the frequency of popular sounding, but unfamiliar songs. A second variable was intent to learn. Participants were either aware of an upcoming frequency test, aware of an upcoming unspecified memory test, or not told memory would be tested and performed a distractor task of completing a math aptitude test.

Tapes were presented to participants which consisted of a series of 10-second song excerpts separated by 5-second silent intervals. For familiar and unfamiliar song tapes, (each of which included two forms), four songs were played once, four songs were played twice, four songs were played three times, and four were played four times. That is, 16 songs were repeated at varying frequencies throughout the tape.

After participants heard the appropriate version of these tapes, a frequency judgment test followed. A tape was played

with the 16 critical songs presented only once, along with four songs not heard in the previous tape. Participants were instructed that after hearing each of the songs, they were to write down the number of times that each song was played in the previous tape.

Several dependent measures were used to assess frequency judgment performance. The first measure consisted of the mean frequency judgments across 30 participants in each group for the four songs at each frequency level. The results from this measure are presented in Figure 1. Analyses of variance performed on the mean data revealed main effects for instructional set and song familiarity. As in our previous study, persons judging unfamiliar music tended to inflate their frequency estimates compared to persons judging familiar music. In addition, frequency judgment ability seemed to be imparied for persons in the distractor condition, but frequency estimation performance of persons in the other two groups did not differ from one another. An interaction between instructions and frequency level was obtained such that the distractor group's estimates were higher at the low true frequency range, and lower near the high true frequency range.

Two additional measures of accuracy were used: "hits" and overall correlations between frequency estimates and true frequency. "Hits" was a measure of absolute frequency judgment accuracy, such that a response was scored a hit if the participant's frequency judgment corresponded exactly to the song's true frequency. A relative frequency judgment accuracy measure

was obtained for each participant by calculating the correlation between presented and judged frequency using all 16 items. Results from both of these measures are presented in Table 1. As with the mean frequency judgment data, results for both absolute and relative frequency judgment measures revealed main effects for instructional set and song familiarity. However, for the familiarity variable, the absolute measure of hits revealed much stronger effects than for the relative measure of accuracy. Because participants in the unfamiliar song group tended to overestimate the true frequency of the songs, their absolute judgments were inflated compared to the familiar music group, and thus accuracy measured by hits was less. However, their relative judgments were more comparable among groups. That is, as true frequency increased, their estimates increased in all conditions.

For both measures, an interaction between familiarity and instructions was due to the fact that subject's estimates in the familiar and unfamiliar conditions were more similar in the distractor condition than they were for the frequency and memory test groups. That is, while the accuracy performance of subjects judging familiar music was clearly superior to that of subjects judging unfamiliar music in the frequency and memory test groups, this difference was not as great for the distractor groups. It may be suggested that familiar songs, overall, are more distinct than unfamiliar songs because they have been cognitively elaborated upon with repeated exposure

over time. Moreover, it is likely that the task present in the distractor condition, interferes with person's ability to process the songs meaningfully, such that the familiar music-distractor group behaves much like the unfamiliar music group.

We were also interested in the effects of music knowledge on the ability to judge frequency of popular songs. After the frequency judgment segment of the experiment, a tape was played containing excerpts of familiar rock music. Participants were asked to provide the names of performers, and titles of the songs if they could do so. This measure was used to identify high and low music-knowledge persons.

We found that participants exhibiting a greater degree of music knowledge were better able to judge the frequency of songs than those without such knowledge. Results for the music knowledge variable are included in Table 2. As can be seen in the overall means reported in the last line of the table, both absolute and relative measures of accuracy revealed superior frequency judgment ability for high-knowledge persons. These differences were significant. Although not seen in Table 1, high knowledge persons were better able to recognize when they did not hear a song, as evidenced by their superiority regarding zero-item judgments.

Participants exhibiting a greater degree of music knowledge are better able to judge frequency than those without such knowledge in both familiar and unfamiliar music conditions. We argue that songs for the high-knowledge group are distinctive, salient, familiar, and possibly have an affective component

which enables persons to readily differentiate between songs. In a sense, persons low in music knowledge are similar to persons in the unfamiliar song conditions. In both cases, songs are not able to be meaningfully elaborated and hence are less able to be discriminated.

To briefly recap the main results of our study, we found the following: first, an effect for intent, such that persons performing a distractor task experienced a decrement in frequency judgment ability, secondly, an effect for stimulus familiarity, such that persons judging unfamiliar music tended to overestimate the number of times that they heard songs and exhibited less absolute and relative accuracy than the familiar music group, and thirdly, an effect for music knowledge, such that high music-knowledge persons exhibited superior frequency judgment accuracy for both absolute and relative measures.

A further comment must be made, however, regarding the intent variable. While it is true that intentional learning groups (that is, the memory test and frequency groups) performed better than incidental learning (or distractor) groups, it is useful to consider the groups' absolute performance. Although the distractor group did not perform as well as the other groups, their performance was still rather good, especially when the nature of the task is taken into consideration. Participants in the distractor condition were performing a math test, told to ignore the music, and in one group, exposed to music they had never before heard. Despite the adversity of these conditions, participants' mean estimates generally increased as true presentation frequencies increased. Given

this fact, it is difficult to entirely dismiss the claim that frequency information is processed automatically. Some degree of "automatic" processing is still apparent.

While the overall results of our experiment do not lend support to a strong theory of automatic processing of frequency information such as that proposed by Hasher and Zacks, it would be unwise to discard such a proposition completely. It is necessary to examine the implications that the results of our study have for an automatic processing theory of frequency information. Perhaps the most reasonable implication involves pointing out that an automatic process can be affected by the intent to learn, by stimulus familiarity, or by stimulus knowledge, contrary to what Hasher and Zacks would suggest. An automatic processing theory of frequency information should perhaps be revised and expanded. Such a revision would include delineating the conduct of automatic processes when pressed to their limits. Similarly, it is suggested that an automatic processing theory be expanded to include the qualification that although generally a robust phenomena, automatic processing may be impaired under conditions in which a great deal of new information is presented. Finally, the expertise which some persons maintain for a given event class, such as music, may enhance discriminability, and in turn, the accuracy of frequency estimation.

Table 1.
Design Used in Experiment

		Instructions: Frequency Group	Memory Test Group	Distractor Group	Overall
Familiar Music	Hits	7.83	7.20	4.47	6.50
	$\bar{x}$	.70	.67	.44	.61
Unfamiliar Music	Hits	4.63	3.77	3.17	3.86
	$\bar{x}$	.52	.53	.43	.49
Overall	Hits	6.23	5.48	3.82	
	$\bar{x}$	.61	.60	.44	

Figure 1.
Mean Estimated Frequency as a Function of True Frequency

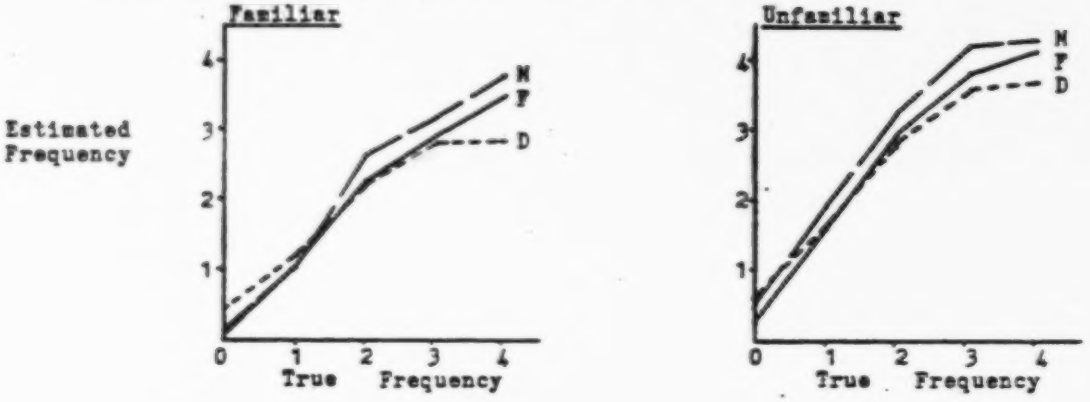

Table 2.
Absolute and Relative Accuracy Measures for 12 Groups

	Mean Hits				Mean Correlations			
	High Knowledge		Low Knowledge		High Knowledge		Low Knowledge	
	Fam.	Unfam.	Fam.	Unfam.	Fam.	Unfam.	Fam.	Unfam.
Frequency	8.71	5.21	6.71	4.43	.75	.57	.65	.46
Memory Test	7.71	4.07	6.50	3.28	.74	.51	.59	.52
Distractor	5.07	2.71	3.86	3.00	.45	.51	.42	.32
Overall	5.58		4.63		.59		.49	

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